

CLAIMS

What is claimed is:

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1. A recording medium, comprising:
real time files requiring real time recording/reproduction; and
a file control information area in which real time recording/reproduction information for ensuring real time recording/reproduction of the real time files is stored.

2. The recording medium as claimed in claim 1, wherein the real time recording/reproduction information includes file indication information indicating that the real time files require real time recording/reproduction.

3. The recording medium as claimed in claim 1, wherein the real time recording/reproduction information includes at least one of recording/reproduction bit rate information, information on minimum contiguous storage blocks satisfying a condition in which a playback time of a current data block is greater than a sum of a seek time and a read time of a data block to be played back next, and information on a playback time for ensuring minimum contiguous storage.

4. The recording medium as claimed in claim 3, wherein the recording/reproduction bit rate information includes control information of a spindle motor.

5. The recording medium as claimed in claim 3, wherein the real time files have sections with different bit rates, and the recording/reproduction bit rate information includes a plurality of bit rate values corresponding to the different bit rates of the sections, and information associated with the sections.

6. The recording medium as claimed in claim 5, wherein the real time recording/reproduction information further includes a maximum allowable value information of a real time recording/reproduction bit rate of the real time files.

1 7. The recording medium as claimed in claim 3, wherein the information on the
2 minimum contiguous storage blocks is determined depending on a maximum seek time of the
3 current data block.

1 8. The recording medium as claimed in claim 3, wherein the minimum
2 contiguous storage blocks are determined in accordance with a size of an error correction
3 code block unit and a maximum seek time of the current data block.

1 9. The recording medium as claimed in claim 8, wherein the real time
2 recording/reproduction information further includes block connecting information for
3 connecting blocks for the minimum contiguous storage blocks, to accomplish the real time
4 reproduction.

1 10. The recording medium as claimed in claim 3, wherein the real time
2 recording/reproduction information further includes attribute information indicating that if an
3 end portion of a file is not filled with data by the minimum contiguous storage blocks, data
4 blocks for the unfilled portion are allocated in advance but unrecorded.

1 11. The recording medium as claimed in claim 3, wherein the real time
2 recording/reproduction information further includes current real time recordable/reproducible
3 state information indicating whether a current file is arranged so as to be
4 recorded/reproduced in real time.

1 12. The recording medium as claimed in claim 3, further comprising a spare area,
2 wherein the real time recording/reproduction information further includes file defect
3 management information indicating that replacement of a defective block with a block in the
4 spare area and rereading or rewriting of the defective block are not attempted when reading
5 or writing of one of the real time files fails.

1 13. The recording medium as claimed in claim 12, wherein the real time
2 recording/reproduction information further includes file allocation information indicating that
3 a data block is not allocated to the defective block replaced by the spare area.

1 14. The recording medium as claimed in claim 3, wherein the real time
2 recording/reproduction information includes file buffering information associated with an
3 amount of data to be initially read from a buffer and an amount of written data to a buffer at
4 a time.

1 15. The recording medium as claimed in claim 3, wherein the real time
2 recording/reproduction information further includes contiguous recording/reproduction type
3 information classified by conditions for controlling the real time files, the conditions
4 including file defect management information, file allocation information, file buffering
5 information, and the information of the minimum contiguous storage blocks.

1 16. A recording medium, comprising:
2 real time files requiring real time recording/reproduction; and
3 a file control information area of a universal disk format (UDF) system in which real
4 time recording/reproduction information for ensuring real time recording/reproduction of the
5 real time files is stored.

1 17. The recording medium as claimed in claim 16, the file control information
2 area includes an extended attribute field of a file entry for the UDF system in which the real
3 time recording/reproduction information is stored.

1 18. The recording medium as claimed in claim 17, wherein the real time
2 recording/reproduction information includes file indication information indicating that the real
3 time files require real time recording/reproduction.

1 19. The recording medium as claimed in claim 17, wherein the real time
2 recording/reproduction information includes at least one of recording/reproduction bit rate
3 information, information on a size of minimum contiguous storage blocks satisfying a
4 condition in which playback time of a current data block is greater than a sum of a seek time
5 and a read time of the current data block to be played back next, and information on a
6 playback time for ensuring minimum contiguous storage.

1 20. The recording medium as claimed in claim 16, wherein the file control
2 information area includes a file identifier descriptor field of the UDF system in which the
3 real time recording/reproduction information is stored.

1 21. The recording medium as claimed in claim 20, wherein the real time
2 recording/reproduction information includes file indication information indicating that the real
3 time files require real time recording/reproduction.

1 22. The recording medium as claimed in claim 16, wherein the file control
2 information area includes a stream directory ICB (information control block) field for the
3 UDF system in which the real time recording/reproduction information is stored.

1 23. The recording medium as claimed in claim 22, wherein the real time
2 recording/reproduction information includes file indication information indicating that the real
3 time files require real time recording/reproduction.

1 24. The recording medium as claimed in claim 22, wherein the real time
2 recording/reproduction information includes at least one of recording/reproduction bit rate
3 information, information on minimum contiguous storage blocks satisfying a condition in
4 which playback time of a current data block is greater than a sum of a seek time and a read
5 time of a data block to be played back next, and information on a playback time for ensuring
6 minimum contiguous storage.

1 25. The recording medium as claimed in claim 16, wherein the file control
2 information area includes a file type field in an ICB TAG field of a file entry for the UDF
3 system in which the real time recording/reproduction information is stored.

1 26. The recording medium as claimed in claim 16, wherein the file control
2 information area includes a file flag field in an ICB TAG field of a file entry for the UDF
3 system in which the real time recording/reproduction information is stored.

1 27. A recording medium comprising real time files requiring real time
2 recording/reproduction, wherein real time recording/reproduction information for ensuring
3 real time recording/reproduction of the real time files is stored in corresponding ones of the
4 real time files.

1 28. The recording medium as claimed in claim 27, wherein the real time
2 recording/reproduction information is stored in a file "RTRW_TS.VOB" in each real time
3 file, respectively, and having a real time rewritable (RTRW) format.

1 29. The recording medium as claimed in claim 27, wherein the real time
2 recording/reproduction information includes file indication information indicating that the
3 corresponding real time files require real time recording/reproduction.

1 30. The recording medium as claimed in claim 27, wherein the real time
2 recording/reproduction information includes at least one of recording/reproduction bit rate
3 information, information on minimum contiguous storage blocks satisfying a condition in
4 which playback time of a current data block is greater than a sum of a seek time and a read
5 time of a data block to be played back next, and information on a playback time for ensuring
6 minimum contiguous storage.

1 31. A recording medium comprising:
2 real time files requiring real time recording/reproduction, and
3 a separate file in which real time recording/reproduction information for ensuring real
4 time recording/reproduction of the real time files is stored.

1 32. The recording medium as claimed in claim 31, wherein the separate file in
2 which the real time recording/reproduction information is stored is a file "RTRW_TS.VOB"
3 in each real time file, respectively, and having a real time rewritable RTRW format.

1 33. The recording medium as claimed in claim 31, wherein the real time
2 recording/reproduction information includes file indication information indicating that the real
3 time files require real time recording/reproduction.

1 34. The recording medium as claimed in claim 31, wherein the real time
2 recording/reproduction information includes at least one of recording/reproduction bit rate
3 information, information on minimum contiguous storage blocks satisfying a condition in
4 which playback time of a current data block is greater than a sum of a seek time and a read
5 time of a data block to be played back next, and information on a playback time for ensuring
6 minimum contiguous storage.

1 35. A recording medium, comprising:
2 real time files requiring real time recording/reproduction; and
3 a volume structure area of a predetermined file system in which real time
4 recording/reproduction information for ensuring real time recording/reproduction of the real
5 time files is stored.

1 36. The recording medium as claimed in claim 35, wherein the real time
2 recording/reproduction information includes file indication information indicating that the real
3 time files require real time recording/reproduction.

1 37. The recording medium as claimed in claim 35, wherein the real time
2 recording/reproduction information includes at least one of recording/reproduction bit rate
3 information, information on minimum contiguous storage blocks satisfying a condition in
4 which playback time of a current data block is greater than a sum of a seek time and a read
5 time of a data block to be played back next, and information on a playback time for ensuring
6 minimum contiguous storage.

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1 38. A recording and reproducing method comprising the steps of:
2 (a) arranging and recording real time files requiring real time recording/reproduction
3 according to real time recording/reproduction in a recording medium according to real time
4 recording/reproduction information for ensuring real time reproduction, and recording the
5 real time recording/reproduction information in the recording medium; and
6 (b) reading and reproducing the real time files using the real time
7 recording/reproduction information.

1 39. The recording and reproducing method as claimed in claim 38, wherein the
2 step (a) comprises storing the real time recording/reproduction information in a file control
3 information area of the recording medium.

1 40. The recording and reproducing method as claimed in claim 38, wherein the
2 step (a) comprises storing the real time recording/reproduction information in a file control
3 information area of a UDF system of the recording medium.

1 41. The recording and reproducing method as claimed in claim 38, wherein the
2 step (a) comprises storing the real time recording/reproduction information in each
3 corresponding real time file.

1 42. The recording and reproducing method as claimed in claim 38, wherein the
2 step (a) comprises the real time recording/reproduction information associated with the real
3 time files in a separate file from the real time files.

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43. The recording and reproducing method as claimed in claim 38, wherein the step (a) comprises storing the real time recording/reproduction information in a volume structure area of the recording medium.

44. The recording and reproducing method as claimed in claim 38, wherein the real time recording/reproduction information includes file indication information indicating that the real time files require real time recording/reproduction.

45. The recording and reproducing method as claimed in claim 38, wherein the real time files have sections with different bit rates, and the real time recording/reproduction information includes recording/reproduction bit rate information which includes information associated with the sections and a plurality of bit rate values corresponding to the different bit rates of the sections.

46. The recording and reproducing method as claimed in claim 45, the step (a) comprises automatically arranging file data areas of the real time files according to the recording/reproduction bit rate information.

47. The recording and reproducing method as claimed in claim 46, wherein the real time recording/reproduction information includes a maximum allowable value of the real time recording/reproduction bit rates.

48. The recording and reproducing method as claimed in claim 38, wherein the real time recording/reproduction information includes at least one of minimum contiguous storage blocks satisfying a condition in which a playback time of a current data block is greater than a sum of the seek time and a read time of a data block to be played back next, and a playback time for ensuring minimum contiguous storage.

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49. The recording and reproducing method as claimed in claim 48, wherein the step (a) comprises arranging the real time files in the minimum contiguous storage blocks.

1 50. The recording and reproducing method as claimed in claim 48, wherein the
2 step (a) comprises the step (a1) if an end portion of one of the real time files is not filled
3 with data by the minimum contiguous storage blocks while the one real time file is recorded
4 in the minimum contiguous storage blocks, recording as the real time recording/reproduction
5 information an attribute indicating that a number of data blocks corresponding to a size of the
6 unfilled portion are allocated but unrecorded.

1 51. The recording and reproducing method as claimed in claim 48, wherein the
2 minimum contiguous storage blocks are classified according to a size of an error correction
3 code block and a maximum seek time.

1 52. The recording and reproducing method as claimed in claim 51, wherein the
2 step (a) comprises arranging the real time files in the classified minimum contiguous storage
3 blocks.

1 53. The recording and reproducing method as claimed in claim 48, wherein the
2 real time recording/reproduction information further includes current real time
3 recordable/reproducible state information indicating whether a current file is arranged so as
4 to be recorded/reproduced in real time.

1 54. The recording and reproducing method as claimed in claim 48, wherein the
2 real time recording/reproduction information further includes contiguous
3 recording/reproduction type information classified by conditions for controlling real time
4 files, the conditions including recording/reproduction bit rate information, file defect
5 management information, file allocation information, file buffering information, and the
6 information of the minimum contiguous storage blocks.

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55. The recording and reproducing method as claimed in claim 48, wherein the real time recording/reproduction information further includes at least one of file defect management information indicating that replacement of a defective block with a block in a spare area of the recording medium and rereading or rewriting of the defective block are not attempted when reading or writing has failed, file allocation information indicating that a data block is not allocated to the defective block replaced by the spare area, and file buffering information associated with an amount of data to be initially read from a buffer and an amount of data written from the buffer at a time.

56. The recording and reproducing method as claimed in claim 38, wherein the step (b) comprises the substeps of:

(b1) reading a volume area on the recording medium; and

(b2) reproducing a file as one of the real time files in consideration of the real time recording/reproduction information if the real time recording/reproduction information exists in the volume area.

57. The recording and reproducing method as claimed in claim 56, wherein the step (b2) comprises analyzing recording/reproduction bit rate information, defect management information, file allocation information, and file buffering information according to the real time recording/reproduction information in the volume area, and reading and reproducing file data in minimum contiguous storage blocks of the file.

58. The recording and reproducing method as claimed in claim 38, wherein the step (b) comprises the substeps of:

(b1) determining whether the real time recording/reproduction information exists in a file area; and

(b2) reproducing a file in consideration of the real time recording/reproduction information if the real time recording/reproduction information exists in the file area.

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2 59. The recording and reproducing method as claimed in claim 58, wherein the
3 step (b2) comprises analyzing recording/reproduction bit rate information, defect
4 management information, file allocation information, and file buffering information according
5 to the real time recording/reproduction information in the file area, and reading and
reproducing file data in minimum contiguous storage blocks.

1 60. The recording and reproducing method as claimed in claim 38, wherein the
2 method further comprises the step of:

3 (c) copying a file to a free area from which a defective block is excluded, based upon
4 the real time recording/reproduction information and general defect management information
5 recorded on the recording medium.

6 61. The recording and reproducing method as claimed in claim 60, wherein the
7 step (c) comprises copying the real time recording/reproduction information and the file
8 together.

9 62. The recording and reproducing method as claimed in claim 60, wherein the
10 step (c) comprises copying only real time file data based on the real time
recording/reproduction information.

1 63. A recording and reproducing apparatus for recording and/or reproducing real
2 time files on a disc using real time recording/reproduction information for ensuring real time
3 recording/reproduction, the apparatus comprising:

4 a codec to compress and encode an input bitstream according to a predetermined
5 compression scheme and to provide compressed and encoded data upon recording on the
6 disc, and decode the compressed and encoded data upon reproduction from the disc;

7 a buffer to temporarily store the compressed and encoded data at a recording bit rate
8 using bit rate information included in the real time recording/reproduction information, and
9 transmitting the compressed and decoded data written on the disc to the codec at a
10 reproduction bit rate;

11 a signal processor to convert the compressed and encoded data stored in the buffer
12 into a signal suitable for recording and transmitting the converted signal together with the
13 real time recording/reproduction information onto the disc upon recording, and reproducing
14 the compressed and encoded data read from the disc according to the real time
15 recording/reproduction information recorded on a predetermined area of the disc; and
16 a controller to control driving of a servo mechanism including a spindle motor
17 according to the bit rate information of the real time recording/reproduction information.

1 64. The recording and reproducing apparatus as claimed in claim 63, wherein the
2 real time files include sections having different bit rates, and the recording/reproduction bit
3 rate information includes information associated with the sections and a plurality of bit rate
4 values corresponding to the different bit rates.

1 65. The recording and reproducing apparatus as claimed in claim 63, wherein the
2 real time recording/reproduction information further includes a maximum allowable value of
3 a real time recording/reproduction bit rate in the real time recording/reproduction
4 information.

1 66. The recording and reproducing apparatus as claimed in claim 63, wherein the
2 controller automatically arranges file data areas of the real time files according to the
3 recording/reproduction bit rate information.

1 67. The recording and reproducing apparatus as claimed in claim 63, wherein the
2 controller stores the real time recording/reproduction information in a file control information
3 area of the disc.

1 68. The recording and reproducing apparatus as claimed in claim 63, wherein the
2 controller stores the real time recording/reproduction information in a file control information
3 area of a universal disc format (UDF) system of the disc.

1 69. The recording and reproducing apparatus as claimed in claim 63, wherein the
2 controller stores the real time recording/reproduction information in each real time file.

1 70. The recording and reproducing apparatus as claimed in claim 63, wherein the
2 controller stores the real time recording/reproduction information associated with the real
3 time files in a separate file of the disc distinct from the real time files.

1 71. The recording and reproducing apparatus as claimed in claim 63, wherein the
2 controller stores the real time recording/reproduction information in a volume structure area
3 of the disc.

1 72. The recording and reproducing apparatus as claimed in claim 63, wherein the
2 real time recording/reproduction information includes file indication information indicating
3 that one of the real time files requires real time recording/reproduction.

1 73. The recording and reproducing apparatus as claimed in claim 63, wherein the
2 real time recording/reproduction information further includes at least one of minimum
3 contiguous storage blocks satisfying a condition in which a playback time of a current data
4 block is greater than a sum of a seek time and a read time of a data block to be played back
5 next, and a playback time for ensuring minimum contiguous storage.

1 74. The recording and reproducing apparatus as claimed in claim 73, wherein the
2 minimum contiguous storage blocks are classified in accordance with a size of an error
3 correction code block and a maximum seek time.

1 75. The recording and reproducing apparatus as claimed in claim 73, wherein the
2 real time recording/reproduction information further includes current real time
3 recordable/reproducible state information representing whether a current file is arranged so
4 as to be recorded/reproduced in real time.

1 76. The recording and reproducing apparatus as claimed in claim 73, wherein the
2 real time recording/reproduction information further includes contiguous
3 recording/reproduction type information classified by conditions for controlling the real time
4 files, the conditions including recording/reproduction bit rate information, file defect
5 management information, file allocation information, file buffering information, and the
6 information of the minimum contiguous storage blocks.

1 77. The recording and reproducing apparatus as claimed in claim 63, wherein the
2 real time recording/reproduction information further includes at least one of file defect
3 management information indicating that replacement of a defective block with a block in a
4 spare area of the disc and rereading or rewriting of the defective block are not attempted
5 when reading or writing has failed, file allocation information indicating that a data block is
6 not allocated to the defective block replaced by the spare area, and file buffering information
7 associated with an amount of data to be initially read from the buffer and an amount of the
8 data written from the buffer at a time.

1 78. A method of operating a file for a system for writing and rewriting real time
2 files to which real time recording/reproduction attribute information is assigned, the method
3 comprising the step of operating the real time files in correspondence with any one process
4 among a real time file creation process, an area allocation process, a recording process, a
5 reproduction process, a deletion process, and a closing process, using the real time
6 recording/reproduction attribute information.

1 79. The method as claimed in claim 78, wherein the real time
2 recording/reproduction attribute information includes file indication information indicating
3 that a file requires real time recording/reproduction.

1 80. The method as claimed in claim 78, wherein the real time
2 recording/reproduction attribute information includes at least one of recording/reproduction
3 bit rate information, information on minimum contiguous storage blocks satisfying a
4 condition in which a playback time of a current data block is greater than a sum of the seek
5 time and a read time of a data block to be played back next, and information on a playback
6 time for ensuring minimum contiguous storage.

1 81. The method as claimed in claim 80, wherein the selected process is the
2 creation process, and the method further comprises the steps of:
3 having an application layer call a kernel layer using a file creation command;
4 having the kernel layer call a file creation function from a device driver by the kernel
5 layer; and
6 having the device driver create one of the real time files by designating real time
7 recording/reproduction attributes, in response to the file creation function being called.

1 82. The method as claimed in claim 80, wherein the selected process is the area
2 allocation process, and the method further comprises the steps of:
3 having an application layer call a kernel layer using a seek command;
4 having the kernel layer call a file seek function from a device driver; and
5 having the device driver check if real time recording/reproduction attributes have been
6 set, in response to the file creation function being called, and pre-allocating an
7 allocated/unrecorded data area having a length for seeking according to a minimum
8 contiguous storage condition specified in the real time recording/reproduction attribute
9 information.

1 83. The method as claimed in claim 80, wherein the selected process is the
2 recording process, and the method further comprises the steps of:
3 having an application layer call a kernel layer using a record command;
4 having the kernel layer call a file recording function from a device driver; and

5 having the device driver check if real time recording/reproduction attributes have been
6 set, in response to the file recording function being called, and recording data in an
7 allocated/unrecorded area of the disc according to a real time recording condition.

1 84. The method as claimed in claim 83, further comprising the steps of:
2 reporting a magnitude of recorded data to the application layer in response to an
3 allocated/unrecorded allocation area being deficient in the recording step;
4 having the application layer pre-allocate the allocated/unrecorded area using the area
5 allocation process with reference to the magnitude of the recorded data; and
6 recording residual data in the pre-allocated area.

1 85. The method as claimed in claim 84, wherein the step of pre-allocating the
2 allocated/unrecorded area comprises the step of automatically pre-allocating the
3 allocated/unrecorded area according to bit rate information set by a file system layer.

1 86. The method as claimed in claim 84, wherein in response to a defective block
2 being generated during the recording of the data in the allocated/unrecorded area in the
3 recording step, excluding the defective block from the allocated/unrecorded area.

1 87. The method as claimed in claim 80, wherein the selected process is the
2 reproduction process, and the method further comprises the steps of:
3 having an application layer call a kernel layer using a reproduction command;
4 having the kernel layer call a file reproduction function from a device driver; and
5 having the device driver check if real time recording/reproduction attributes have been
6 set, in response to the file reproduction function being called, and reproducing data from the
7 disc according to a real time reproduction condition.

1 88. The method as claimed in claim 80, wherein the selected process is the
2 deletion process, and the method further comprises the steps of:
3 having an application layer call a kernel layer using a deletion command;

4 having the kernel layer call a file deletion function from a device driver; and
5 having the device driver check if real time recording/reproduction attributes have been
6 set, in response to the file deletion function being called, and deleting data from the disc
7 according to a real time condition.

1 89. The method as claimed in claim 88, further comprising the steps of allocating
2 the deletion area to a free area, and managing data in a padding space of an A/V data section
3 pertaining to the deletion area among an error correction code (ECC) block ranging over a
4 boundary of the deletion area as a separate file on a system file of the disc.

1 90. The method as claimed in claim 89, further comprising storing and managing
2 the data from the padding space in an allocation descriptor list in an ECC padding entry,
3 wherein the padding space pertaining to the deletion area in an ECC block ranging over the
4 boundary of the deletion area and an A/V file space not pertaining to the deletion area have
5 extent lengths.

1 91. The method as claimed in claim 80, wherein the selected process is the closing
2 process, and the method comprises the steps of:

3 having an application layer call a kernel layer using a close command;
4 having the kernel layer call a file closing function from a device driver; and
5 having the device driver update file control information and disc information in
6 response to the file closing function being called.

1 92. The recording medium as claimed in claim 3, wherein the real time
2 recording/reproduction information further includes current real time recordable/reproducible
3 state information indicating whether it is possible to record/reproduce a current file in real
4 time.

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93. The recording and reproducing method as claimed in claim 48, wherein the
- 1 real time recording/reproduction information further includes current real time
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 - 3 recordable/reproducible state information indicating whether it is possible to record/reproduce
 - 4 a current file in real time.

94. The recording and reproducing apparatus as claimed in claim 73, wherein the
- 1 real time recording/reproduction information further includes current real time
 - 2
 - 3 recordable/reproducible state information indicating whether it is possible to record/reproduce
 - 4 a current file in real time.

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